



Designation: E 376 – 96

An American National Standard

Standard Practice for Measuring Coating Thickness by Magnetic-Field or Eddy- Current (Electromagnetic) Test Methods¹

This standard is issued under the fixed designation E 376; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

This standard has been approved for use by agencies of the Department of Defense.

1. Scope

1.1 This practice covers the use of magnetic- and eddy-current-type thickness instruments (gages) for nondestructive thickness measurement of a coating on a metal substrate.

1.2 More specific uses of these instruments are covered by the following test methods issued by ASTM: Test Methods B 244, B 499, B 530, D 1186, D 1400, and G 12.

1.3 The values stated in SI units are to be regarded as standard. The inch-pound units in parentheses are for information only and may be approximate.

1.4 Measurements made in accordance with this test method will be in compliance with the requirements of ISO International Standard 2178 as printed in 1982.

1.5 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 ASTM Standards:

B 244 Test Method for Measurement of Thickness of Anodic Coatings on Aluminum and of Other Nonconductive Coatings on Nonmagnetic Basis Metals with Eddy-Current Instruments²

B 499 Test Method for Measurement of Coating Thicknesses by the Magnetic Method: Nonmagnetic Coatings on Magnetic Basis Metals²

B 530 Test Method for Measurement of Coating Thicknesses by the Magnetic Method: Electrodeposited Nickel Coatings on Magnetic and Nonmagnetic Substrates²

D 1186 Test Methods for Nondestructive Measurement of Dry Film Thickness of Nonmagnetic Coatings Applied to a Ferrous Base³

D 1400 Test Method for Nondestructive Measurement of Dry Film Thickness of Nonconductive Coatings Applied to a Nonferrous Metal Base³

E 1316 Terminology for Nondestructive Examinations⁴

G 12 Test Method for Nondestructive Measurement of Film Thickness of Pipeline Coatings on Steel⁵

2.2 International Standard:

ISO 2178 Nonmagnetic Coatings on Magnetic Substrate—Measurement of Coating Thickness—Magnetic Method⁶

NOTE 1—See Appendix X1.

3. Terminology

3.1 *Definitions*—Definitions of terms relating to electromagnetic testing are given in Terminology E 1316.

4. Significance and Use

4.1 *General*—No presently available thickness gage is applicable to all combinations of coating-substrate thicknesses and materials. The limitations of a particular instrument are generally delineated by its manufacturer.

4.2 *Magnetic*—Magnetic-type gages measure either magnetic attraction between a magnet and a coating or its substrate, or reluctance of a magnetic flux path passing through the coating and substrate. These gages are designed to measure thickness of a nonmagnetic coating on a magnetic substrate. Some of them will also measure thickness of nickel coatings on a magnetic or nonmagnetic substrate.⁷

4.3 *Eddy Current*—Eddy-current-type thickness gages are electronic instruments that measure variations in impedance of an eddy-current inducing coil caused by coating thickness variations. They can only be used if the electrical conductivity of the coating differs significantly from that of the substrate.

¹ This practice is under the jurisdiction of ASTM Committee E-7 on Nondestructive Testing and is the direct responsibility of Subcommittee E07.07 on Electromagnetic Method.

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² *Annual Book of ASTM Standards*, Vol 02.05.

³ *Annual Book of ASTM Standards*, Vol 06.01.

⁴ *Annual Book of ASTM Standards*, Vol 03.03.

⁵ *Annual Book of ASTM Standards*, Vol 06.02.

⁶ Available from American National Standards Institute, 11 West 42nd Street, 13th Floor, New York, NY 10036.

⁷ Autocatalytically deposited nickel-phosphorus alloys containing more than 8 % phosphorus are sufficiently nonmagnetic to be measured by this method, as long as the measurement is made prior to any heat treatment.